Dec. 29, 1959 B. D. MULL ET AL 2,919,098

ADJUSTABLE SUPPORT FOR LIGHTS AND THE LIKE

Filed March 20, 1956 3 Sheets-Sheet 1

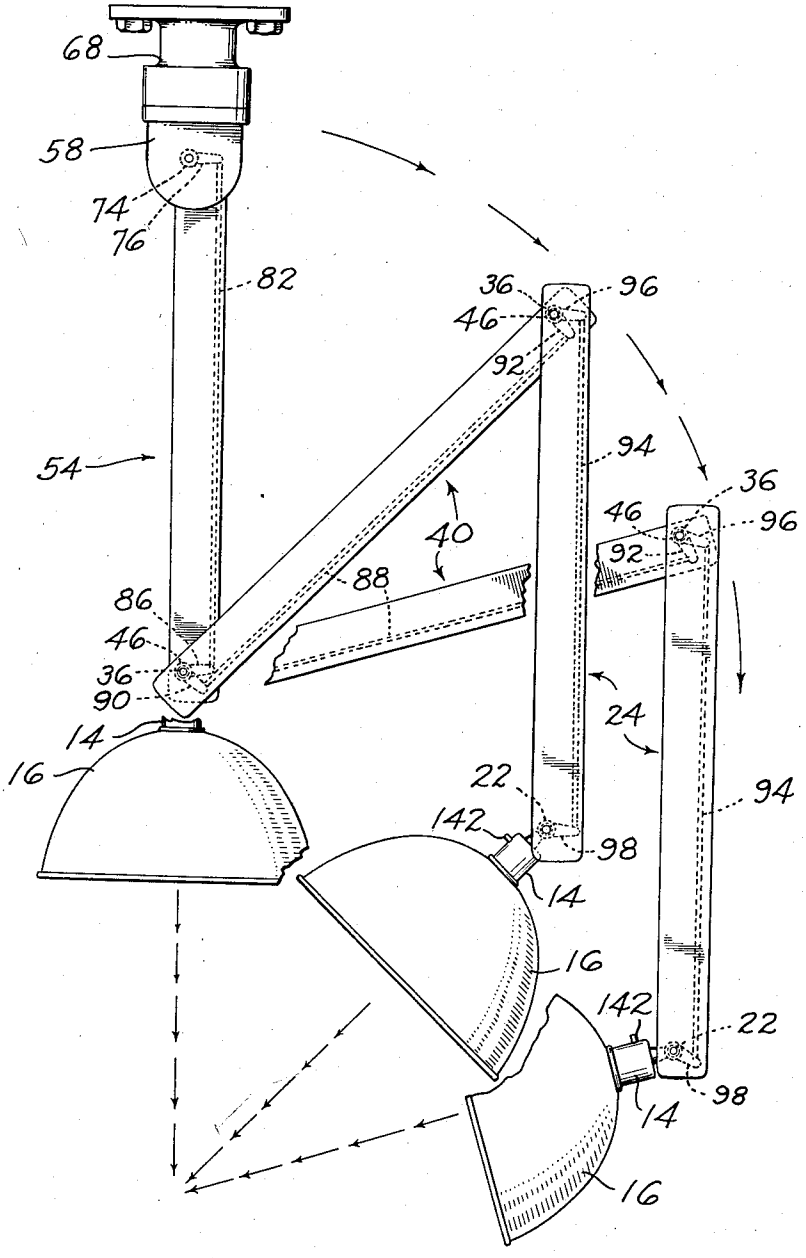


Fig. 1.

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ADJUSTABLE SUPPORT FOR LIGHTS AND THE LIKE

Filed March 20, 1956 3 Sheets-Sheet 2

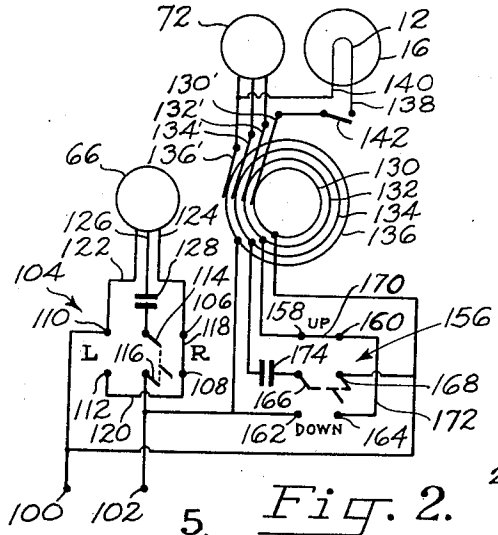


Fig. 2.

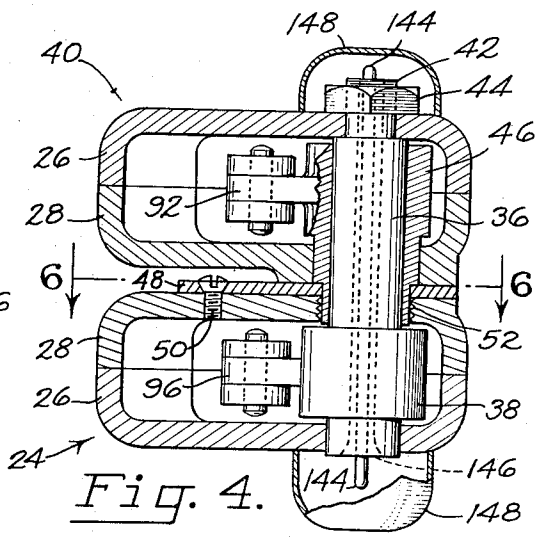


Fig. 4.

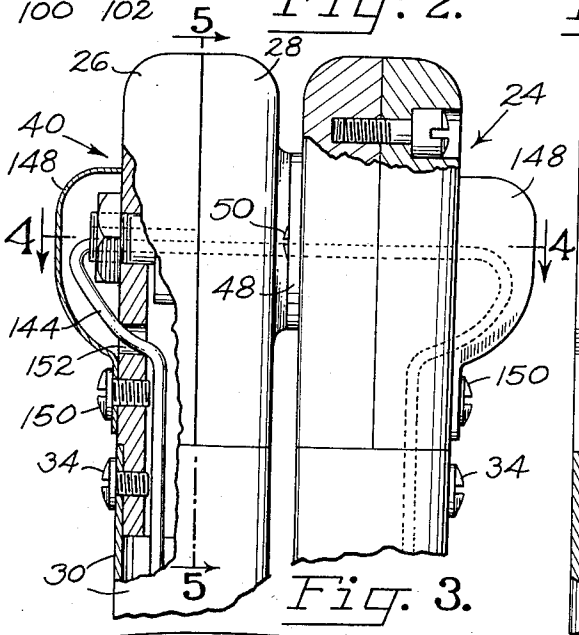


Fig. 3.

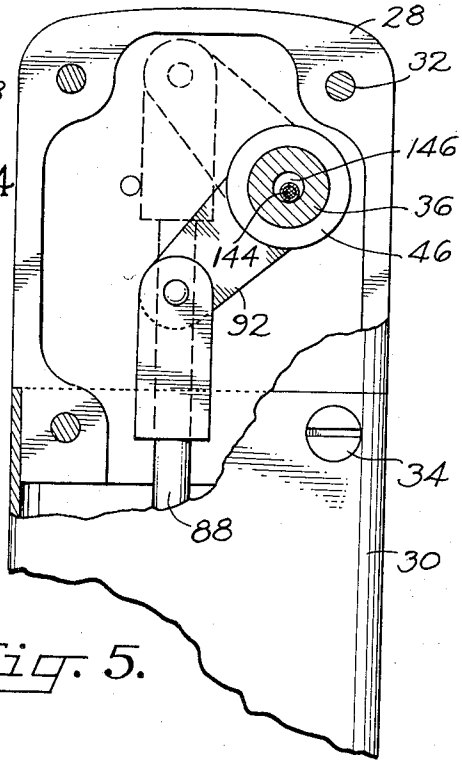


Fig. 5.

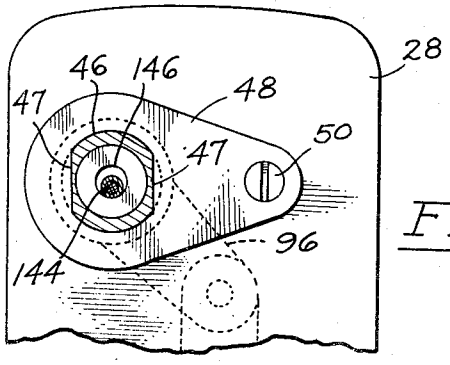


Fig. 6.

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ADJUSTABLE SUPPORT FOR LIGHTS AND THE LIKE

Filed March 20, 1956 3 Sheets-Sheet 3

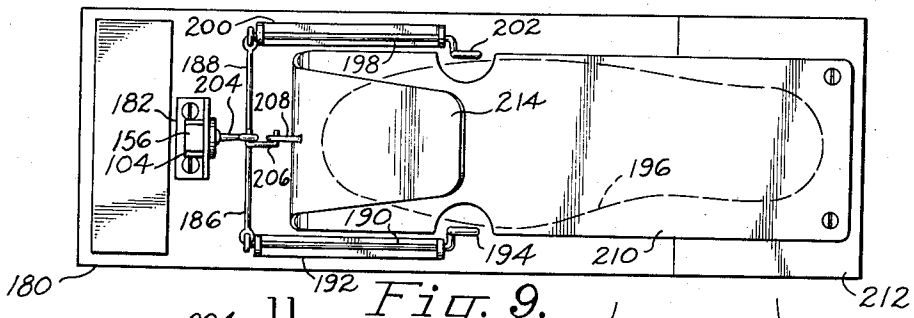


Fig. 9.

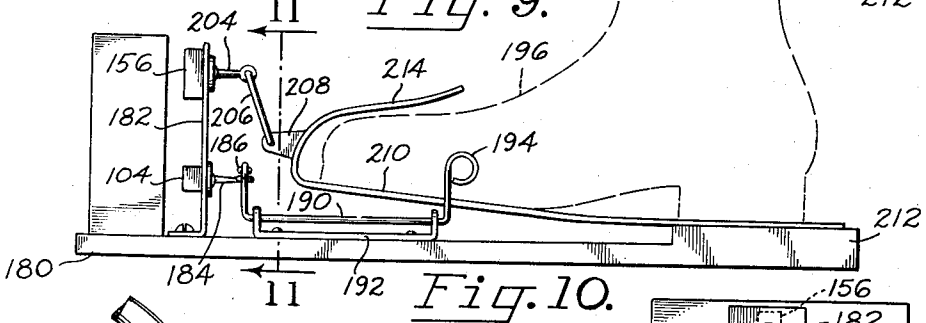


Fig. 10.

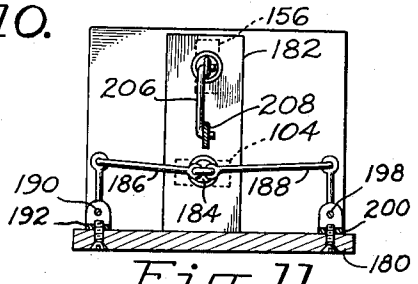


Fig. 11.

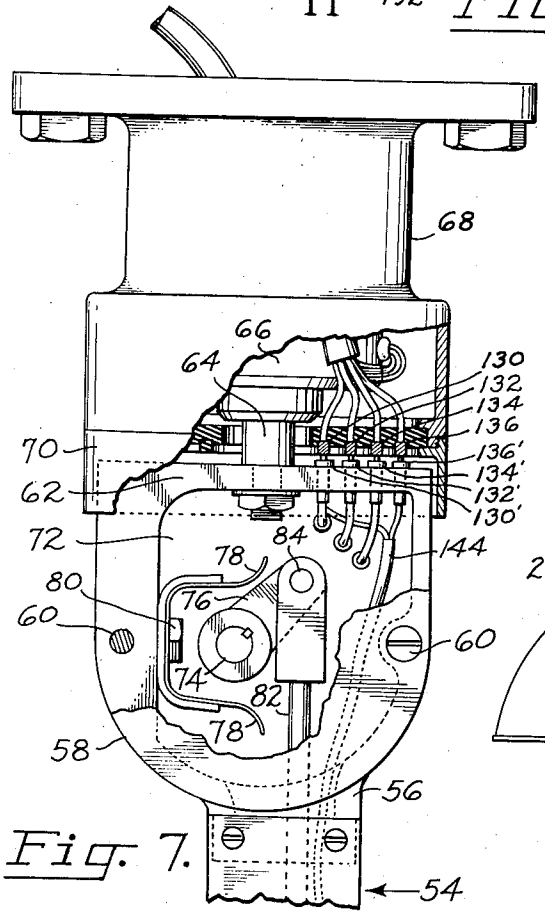


Fig. 7.

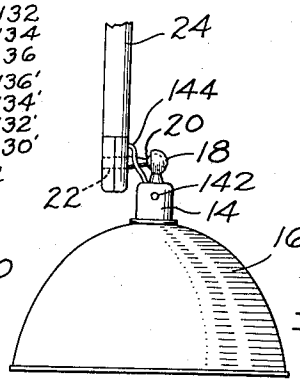


Fig. 8.

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2,919,098

ADJUSTABLE SUPPORT FOR LIGHTS AND THE LIKE

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Application March 20, 1956, Serial No. 572,647

14 Claims. (Cl. 248—324)

This invention pertains to adjustable supports, and relates particularly to a support for lights and the like which may be adjusted from a remote position.

It is a principal object of the present invention to provide a support for lights and the like which is adjustable from a remote position through a substantial range in elevation and azimuth.

Another important object of this invention is the provision of a support for lights and the like which is adjustable in elevation and azimuth and which maintains a light or the light aimed on a given area or spot during said adjustment.

A further important object of this invention is the provision of an adjustable support particularly adapted to support an operating room light and to adjust said light in elevation and azimuth while maintaining the light aimed on a given area.

Still another important object of the present invention is to provide an operating room light support, the adjustment of which is under the direct control of the surgeon.

A still further important object of this invention is the provision of an adjustable operating room light support which may be controlled directly by the surgeon without contamination of hands, clothes, or other articles comprising the sterile field.

Another object of this invention is to provide an adjustable support for lights and the like which is of simplified construction for economical manufacture, which is faithful and precise in operation, and requires a minimum of maintenance and repair.

The foregoing and other objects and advantages of this invention will appear from the following detailed description, taken in connection with the accompanying drawings, in which:

Figure 1 is a view in side elevation of an adjustable support embodying the features of the present invention, the same being shown supporting a light in various positions of adjustment;

Figure 2 is a schematic diagram of an electric circuit for controlling the operation of the adjustable support;

Figure 3 is a fragmentary view in side elevation, partly in section, showing details of internal construction of pivoted sections of the adjustable support;

Figure 4 is a sectional view taken along the line 4—4 in Figure 3;

Figure 5 is a fragmentary sectional view taken along the line 5—5 in Figure 3;

Figure 6 is a fragmentary sectional view taken along the line 6—6 in Figure 4;

Figure 7 is a fragmentary view in side elevation, partly in section, showing details of assembly of the elevation and azimuth motors;

Figure 8 is a fragmentary view in side elevation showing an adjustable mounting for a light reflector;

Figure 9 is a plan view of a remotely positioned control station for operating the adjustable support, the control being operable by the foot, as indicated in dashed lines;

Figure 10 is a view in side elevation of the foot operated control station shown in Figure 9; and

Figure 11 is a sectional view taken along the line 11—11 in Figure 10.

As indicated hereinbefore, the adjustable support of the present invention may be employed for the support of lights and various other devices. For purposes merely of illustration, the same is shown in the drawing supporting a light and associated reflector for controlled movement in azimuth and elevation, and is described hereinafter in use as an operating room light under the direct control of the surgeon.

Referring to the drawings, the lamp **12** (Figure 2) is supported in a socket base **14** (Figure 1) upon which is mounted a reflector **16**, preferably of the explosion-proof type for the use illustrated. Extending from the socket base (Figure 8) is the cup section **18** of a swivel joint connection. The ball section **20** thereof is formed as a lateral extension of a pivot shaft **22** which is mounted for rotation adjacent one end of the terminal arm member **24** of the adjustable support. This arm member, as well as the other associated arm members disclosed hereinafter, is hollow and preferably is constructed of two longitudinal halves, in the manner best illustrated in Figures 3 to 6. Each of the opposite ends of the arm is formed of two longitudinal half sections **26**, **28** which, when placed together, form terminal supports for the elongated hollow tubes **30**, which form the intermediate length of the hollow arm. The halves of the terminal sections of the arm are secured together by such means as the screws **32**, and the hollow tubes **30** are secured to said terminal ends by such means as the screws **34**.

Mounted rotatably in the end of the terminal arm **24** opposite the shaft **22** is a second shaft **36** provided with an enlarged section **38** positioned within the end of arm **24**. As indicated in Figure 4 of the drawings, this shaft extends laterally from the arm **24** through an opening adjacent one end of the intermediate arm **40** which overlaps the terminal arm **24**. The terminal end of shaft **36** is reduced in diameter and provided with threads **42**, said reduced terminal section extending through an opening in the intermediate arm and secured firmly thereto by means of the nut **44**. Thus, the shaft **36** and intermediate arm **40** are secured together for simultaneous rotation.

A sleeve **46** is mounted rotatably on the section of shaft **36** contained within the overlapping end of arm **40**. A lateral extension of the sleeve is reduced in diamter and formed with flattened sides **47** (Figure 6) which projects through a similarly shaped opening in plate **48** secured to the arm **24** by screw **50**. This arrangement prevents relative rotation of the sleeve **46** and arm **24**. The sleeve extension is secured to arm **24** by means of the interengaging threads **52**.

The foregoing assembly of shaft **36** and the concentric sleeve **46** is duplicated at the end of the intermediate arm **40** opposite the assembly just described, for interconnecting the intermediate arm and the base arm **54**. Thus, a second shaft **36** is mounted for rotation in the intermediate arm **40**, the shaft extending laterally through an opening adjacent one end of the base arm **54**. The shaft is secured firmly to the base arm by means of the reduced threaded terminal section **42** and nut **44**, in the manner previously explained. A second sleeve **46** is mounted for rotation on the second shaft **36** within the base arm **54** and extends laterally therefrom for attachment to the intermediate arm by means of the interengaging threads **52** and plate **48** described hereinbefore.

The end of the base arm **54** opposite the end overlapping the intermediate arm **40** is secured firmly to a hol-

low boss 56 (Figure 7) projecting from the cylindrical housing 58. For convenience of assembly, the latter is preferably constructed as longitudinal halves which are secured together detachably by such means as the screws 60. This housing carries a base plate 62 at the end opposite the boss, and to this base plate is secured the drive shaft 64 of the azimuth motor 66 contained within the pedestal 68. A cylindrical shield 70 is secured removably to the pedestal to overlap the base plate 62 to protect the electrical connections described hereinafter from contamination.

It will be apparent that operation of the azimuth motor 66 results in rotation of the housing 58 and the attached arms and lamp assembly about the axis of the azimuth motor drive shaft 64.

Within the housing 58 is contained the elevation motor 72. To the drive shaft 74 of this motor is keyed or otherwise secured the lever 76. This lever thus is adapted to be rotated by the elevation motor through an arc limited by the resilient abutments 78 which are mounted within the housing 58 by such means as the bolt 80 and positioned to engage the lever at the opposite ends of movement of the latter.

A rod 82 extends through the hollow base arm 54 and is connected pivotally to the lever 76 by such means as the pivot pin 84. The opposite end of the rod is connected pivotally to a lever 86 which is secured to the sleeve 46 contained within the base arm adjacent the end to which the intermediate arm is pivotally connected.

In similar manner, a second rod 88 extends through the hollow intermediate arm 40 and is connected pivotally at one end to a lever 90 secured to the shaft 36 at the end overlapping the base arm 54. The opposite end of the second rod is pivotally connected to a lever 92 which is secured to the sleeve 46 contained within the intermediate arm adjacent the end to which the terminal arm 24 is pivotally connected.

Similarly, a third rod 94 extends through the hollow terminal arm 24 and is pivotally connected at one end to a lever 96 which is secured to the shaft 36 contained within the terminal arm adjacent the end overlapping the intermediate arm 40. The opposite end of the third rod 94 is connected pivotally to a lever 98, which is secured to the shaft 22 which carries the ball member 20 of the swivel support for the lamp assembly.

Operation of the elevation motor causes rotation of the motor drive shaft 74 and the attached lever 76. By connection of this lever through rod 82, lever 86 and sleeve 46 to the intermediate arm 40, rotation of said lever 76 causes simultaneous rotation of the intermediate arm.

However, it is to be noted that lever 90 is secured to shaft 36 which is mounted adjacent to and in fixed position with respect to the base arm 54, and therefore the lever 90 does not rotate with the intermediate arm. Accordingly, the position of lever 90 and also lever 92, interconnected by rod 88, does not change position with respect to the longitudinal axis of the base arm 54 as the intermediate arm rotates. By virtue of this fixed position of lever 90 with respect to the base arm, the levers 90 and 92 change position with respect to the longitudinal axis of the intermediate arm. Since the lever 92 is connected through sleeve 46 to the terminal arm 24, the latter also rotates with respect to the intermediate arm.

Since the lever 96 carried by the terminal arm 24 is fixed with respect to the intermediate arm 40 by virtue of its positive connection therewith through shaft 36, the displacement of the terminal arm with respect to the intermediate arm causes the lever 96 and also the lever 98, connected thereto by rod 94, to shift with respect to the longitudinal axis of the terminal arm 24. By such relative displacement of the lever 98, rotation of shaft 22 causes a simultaneous movement in position of the lamp socket 14.

In the embodiment illustrated wherein the support is employed as an adjustable mounting for an operating room light, it is preferred that all of the levers have the same length, for by this construction the lamp is directed always at the same spot or area for all positions of adjustment in elevation and azimuth, as indicated in Figure 1 of the drawings.

Referring now to Figure 2 of the drawings, there is shown an electric circuit by means of which to control the operation of the adjustable support. Electric potential is supplied from a source (not shown) to terminals 100 and 102.

An azimuth switch 104 is provided with two pairs of switch contacts 106, 108 and 110, 112, to which the switch arms 114 and 116 may be releasably connected. Switch contacts 106 and 108 are connected together through jumper 118, and contacts 108 and 112 are connected together through conductor 120. Conductor 122 connects the azimuth motor 66 to switch contact 110 which is connected to terminal 100 of the electric supply, and conductor 124 connects the motor to switch contact 106. The common line 126 connects the motor to switch arm 114 through capacitor 128, and the second switch arm 116 is connected to terminal 102 of the electric supply, as shown. It will be apparent that when the switch arms extend to the right in Figure 2 in engagement with the switch contacts 106 and 108, the azimuth motor will be energized to rotate the lamp supporting assembly in one direction, while reverse rotation will result when the switch arms are extended to the left in engagement with the pair of switch contacts 110 and 112.

Since the elevation motor 72 and the lamp 12 are mounted to rotate relative to the pedestal 68, electrical connections to these elements are made by collector rings and associated contact brushes. Thus, as best shown in Figure 7 of the drawings, concentric collector rings 130, 132, 134 and 136 are mounted upon the pedestal 68 adjacent the base member 62 of housing 58. They are electrically insulated from each other and from the pedestal, in well known manner. Associated contact brushes 130', 132', 134' and 136', respectively, are mounted in the base member 62 for sliding engagement with the associated collector rings. The brushes also are electrically insulated from each other and from the base member.

The two electrical conductors 138, 140 for the lamp 12 are connected to the brushes 130' and 136', respectively, which engage the inner and outer collector rings 130 and 136. These collector rings are connected directly to the terminals 100 and 102, respectively, of the electrical supply. A switch 142 is carried in the lamp socket base 14 for manual control of the lamp.

The conductors 138, 140 supplying electric potential to the lamp are confined in a sheathing 144 which extends from the lamp socket base to the contact brushes, and this sheathing is reeved through longitudinal openings 146 provided in each of the shafts 36. As best shown in Figures 3 and 4 of the drawings, the ends of said shafts are closed by sealing caps 148 which are secured to the terminal sections of the arms by such means as the screws 150. Openings 152 in these terminal sections of the arms permit the sheathing to be reeved back into the interior of the hollow arms. Thus, the electrical conductors of the lamp extend through each of the elongated hollow arms from the brushes and emerge from the terminal arm 24 adjacent the shaft 22, and then enter the lamp socket base 14 for connection to the lamp, in the usual manner.

Referring again to Figure 2, an elevation switch 156 is provided with two pairs of contacts 158, 160 and 162, 164 which are adapted to be engaged selectively by the switch arms 166 and 168. The pair of contacts 158, 160 are connected together through jumper 170, and the contacts 160 and 164 are interconnected by conductor 172. Contact 162 is connected to the outermost collector ring 136 and also to terminal 102 of the electric supply. Contact 158 is connected to the second innermost collector

ring 132. Switch arm 168 is connected to the innermost collector ring 130 and also to terminal 100 of the electric supply, while switch arm 166 is connected to the second outermost collector ring 134 through capacitor 174. The brush contacts 132', 134', 136' interconnect the elevation motor 72 and the collector rings 132, 134, 136, respectively.

It will be apparent that when the contact arms of the elevation switch 156 are in the Down position, engaging the contacts 162, 164, the elevation motor will be energized through collector rings 132 and 134 to drive the motor in the direction to lower the lamp, i.e. to move the lamp farther from the pedestal 68. Conversely, when the switch arms are in the Up position, the elevation motor will be energized through collector rings 134 and 136 to drive the motor in the opposite direction and draw the lamp upwardly, i.e. closer to the pedestal.

In the illustrated embodiment wherein the support is utilized as an adjustable mounting for an operating room light, it is desirable that operation of the support be under the direct control of the surgeon. Accordingly, means is provided by which the azimuth switch and elevation switch may be manipulated selectively by the foot. Referring to Figures 9, 10 and 11 of the drawings, a base plate 180 supports an upstanding bracket 182 adjacent its forward end. The azimuth switch 104 is mounted on the bracket with its toggle arm 184 projecting rearwardly. The toggle arm is positioned for movement laterally, i.e. toward the sides of the base plate. Connected to the end of the toggle arm are a pair of actuating rods 186, 188, which extend laterally therefrom. Actuating rod 186 is connected pivotally to the forward upturned end of the U-shaped rod 190 which is mounted rotatably in the upturned ends of bracket 192 secured to the base plate 180 adjacent the left edge of the latter. The rearward upturned end of the U-shaped rod terminates in an abutment 194 which is positioned for engagement by the side of a foot 196.

In similar manner, actuator rod 188 is pivotally connected to the forward upturned end of the U-shaped rod 198 which is mounted for rotation in the upturned ends of bracket 200 secured to the base plate 180 adjacent the right edge. The rearward upturned end of the U-shaped rod terminates in an abutment 202 positioned for engagement by the opposite side of the shoe.

The elevation switch 156 is mounted upon the bracket 182 above the azimuth switch, and its toggle arm 204 projects rearwardly for movement in a vertical plane. The terminal end of the toggle arm is pivotally connected through link 206 to a forward projection 208 on the forward end of the foot pedal 210.

The foot pedal 210 comprises a flexible metal plate which is secured at its rearward end on an elevated portion 212 of the base member. The foot pedal extends forwardly, and its forward section is looped upward and rearward to form a cover section 214. Thus, the heel of a shoe rests upon the elevated portion of the base member and the toe of the shoe projects forwardly into the space between the foot pedal base and cover plate, as best illustrated in Figure 10.

By the foregoing construction, it will be apparent that the surgeon may control the direction of rotation of the azimuth motor, and hence the rotation of the lamp in a horizontal plane, by moving his foot to one side or the other to engage the abutments 194, 202, and thereby selectively operate the azimuth switch. Similarly, by moving the toe of the shoe in a vertical plane, the surgeon may move the toggle arm of the elevation switch up or down selectively to control the elevation motor and hence the position of elevation of the lamp. By proper manipulation of the foot the azimuth and elevation motors may be actuated simultaneously.

It will be apparent to those skilled in the art that various changes and modifications of the structural details described hereinbefore may be made without departing from the scope and spirit of the present invention. For example, the adjustable support is shown in Figure 1 as being suspended from an overhead support, such as ceiling. Alternatively, the support may be mounted upon an overhead track for convenient movement between stations. It may also be mounted upon a vertical wall, or supported from a floor. In addition, two or more parallel sets of supports may be connected to a single foot control for simultaneous operation.

The electric azimuth and elevation motors may be replaced by hydraulic motors or other suitable sources of power. The motors may be operated from the foot control mechanism described hereinbefore, or by similar means operated by the knee or other part of the body. Where maintenance of a sterile field is not a requirement, the motors may be operated by a hand lever, or by push buttons.

In the embodiment illustrated, it is desired that the lamp direct a concentrated beam of light upon a small area throughout the range of adjustment of the support. By proper selection of the reflector, the size of the illuminated area may be varied. Further, in some instance it may be desirable to vary the pattern of illumination as the support is operated through its range of adjustment. This may be achieved, for example, by moving the lamp assembly (Figure 1) on its swivel joint in such manner that the beam of light is directed obliquely with respect to the base arm 54 when the support is in its extreme position of elevation, as indicated by the left hand position of the reflector. By such adjustment, the beam of light will trace a line as the elevation is varied, and will trace circles as the azimuth motor rotates the support assembly. Such pattern may also be obtained by varying the lengths of the interconnected levers.

Since the levers and interconnecting rods function to cause relative rotation of the associated shafts and sleeves, it will be apparent that the levers and rod may be replaced by pulleys and belts, or sprockets and chains, respectively.

As mentioned hereinbefore, the adjustable support may function as a mounting for devices other than lamps. As an example, it may be desirable to employ the adjustable support in an operating room for directing a television camera tube, alone or in combination with lighting fixtures, upon the area under operation, for such purposes as lecture demonstrations.

Since the foregoing and other changes and modifications may be made within the scope of the present invention, it is to be understood that the foregoing description is primarily illustrative of the invention and is not to be considered as limiting the scope thereof.

Having now described our invention and the manner in which the same may be used, what we claim as new and desire to secure by Letters Patent is:

1. An adjustable support for lights and the like, comprising a base, arm supporting means on the base, first and second arm members arranged to overlap at one of their ends, first pivot means supporting the first arm member on the arm supporting means at the end opposite the overlapping end, second pivot means interconnecting the first and second arm members at their overlapping ends, third pivot means mounted rotatably on the second arm member adjacent the end opposite the overlapping end, support means mounted on the third pivot means for supporting a light or the like, first operating means operatively interconnecting the arm supporting means and second arm member at points spaced from the respective first and second pivot means, and second operating means operatively interconnecting the first arm member and support means at points spaced from the respective second and third pivot means.

2. The adjustable support of claim 1 wherein the arm supporting means and support means for a light or the like each has a longitudinal axis and wherein the points

of interconnection of the arm supporting means and second arm member are equally distant from the respective first and second pivot means, whereby to maintain the longitudinal axes of the arm supporting means and second arm member parallel to each other, and wherein the points of interconnection of the first arm member and support means are equally distant from the respective second and third pivot means, whereby to maintain the longitudinal axes of the first arm member and support means parallel to each other.

3. The adjustable support of claim 1 including first drive means for rotating the arm supporting means axially, and second drive means for pivoting the first arm member relative to the arm supporting means.

4. The adjustable support of claim 3 wherein the first and second drive means are electrically actuated reversible motors each having an electric circuit, and including a first reversing switch in the circuit of the first drive motor, and a second reversing switch in the circuit of the second drive motor, the first and second reversing switches being positioned remotely from the adjustable support for controlling the operation of said motors.

5. An adjustable support for lights and the like, comprising a base, arm supporting means on the base, first and second arm members arranged to overlap at one of their ends, first pivot means secured to the arm supporting means and pivotally supporting the first arm member at its end opposite the overlapping end, second pivot means mounted rotatably on the overlapping end of the first arm member and secured to the overlapping end of the second arm member, third pivot means mounted rotatably on the overlapping end of the second arm member and secured to the overlapping end of the first arm member, the second and third pivot means being coaxial, fourth pivot means mounted rotatably on the second arm member adjacent the end opposite the overlapping end, support means mounted on the fourth pivot means for supporting a light or the like, first operating means interconnecting the first and second pivot means at points spaced radially from the axes of said pivot means, and second operating means interconnecting the third and fourth pivot means at points spaced radially from the axes of said pivot means.

6. The adjustable support of claim 5 wherein the arm supporting means and support means for a light on the like each has a longitudinal axis and wherein the points of interconnection of the first and second pivot means are equally distant from the respective first and second pivot means, whereby to maintain the longitudinal axes of the arm supporting means and second arm member parallel to each other, and wherein the points of interconnection of the third and fourth pivot means are equally distant from the respective third and fourth pivot means, whereby to maintain the longitudinal axes of the first arm member and support means parallel to each other.

7. The adjustable support of claim 5 including rotary drive means for rotating the arm supporting means axially.

8. The adjustable support of claim 5 including first reversible drive means for rotating the arm supporting means axially, and second reversible drive means for pivoting the first arm relative to the arm supporting means.

9. The adjustable support of claim 8 including remotely positioned drive control means associated with the first and second drive means for actuating the latter, and means interconnecting said drive means and remotely positioned drive control means.

10. The adjustable support of claim 9 wherein the first and second drive means are electrically actuated reversible motors each having an electric circuit, and the remotely positioned control means comprises a first reversing switch in the circuit of the first drive motor, and a second reversing switch in the circuit of the second drive motor.

11. The adjustable support of claim 9 wherein the first and second drive means are electrically actuated reversible motors each having an electric circuit, and the remotely positioned control means comprises a foot base member, a first reversing switch in the circuit of the first drive motor and mounted on the foot base member for actuation by lateral movement of the foot, and a second reversing switch in the circuit of the second drive motor and mounted on the foot base member for actuation by vertical movement of the foot.

12. An adjustable support for lights and the like, comprising a base arm member, first reversible drive means supporting the base arm member at one end for axial rotation, an intermediate arm member arranged with one end overlapping the end of the base arm member opposite the supporting means, first pivot means mounted rotatably on the end of the base arm member overlapping the intermediate arm member and secured to the latter, second pivot means mounted rotatably on the end of the intermediate arm member overlapping the base arm member and secured to the latter, a terminal arm member arranged with one end overlapping the end of the intermediate arm member opposite the end overlapping the base arm member, third pivot means mounted rotatably on the end of the intermediate arm member overlapping the terminal arm member and secured to the latter, fourth pivot means mounted rotatably on the end of the terminal arm member overlapping the intermediate arm member and secured to the latter, fifth pivot means mounted rotatably on the terminal arm member adjacent the end opposite the overlapping end, support means mounted on the fifth pivot means for supporting a light or the like, first operating means interconnecting the second and third pivot means at points spaced radially from the axes of said pivot means, second operating means interconnecting the fourth and fifth pivot means at points spaced radially from the axes of said pivot means, second reversible drive means engaging the first pivot means for pivoting the intermediate arm member relative to the base arm member, and remotely positioned drive control means associated with the first and second drive means for actuating the latter selectively, and means interconnecting said drive means and remotely positioned drive control means.

13. The adjustable support of claim 12 wherein the first and second drive means are electricaly actuated reversible motors each having an electric circuit, and the remotely positioned drive control means comprising a first reversing switch in the circuit of the first drive motor, and a second reversing switch in the circuit of the second drive motor.

14. The adjustable support of claim 12 wherein the first and second drive means are electrically actuated reversible motors each having an electric circuit, and the remotely positioned drive control means comprises a foot base member, a first reversing switch in the circuit of the first drive motor and mounted on the foot base member for actuation by lateral movement of the foot, and a second reversing switch in the circuit of the second drive motor and mounted on the foot base member for actuation by vertical movement of the foot.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,919,098 December 29, 1959

Bruce D. Mull et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 45, for "on the" read -- or the --; line 62, after "arm" insert -- member --; line 66, after "latter" insert -- selectively --; column 8, line 48, for "comprising" read -- comprises --.

Signed and sealed this 14th day of June 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents